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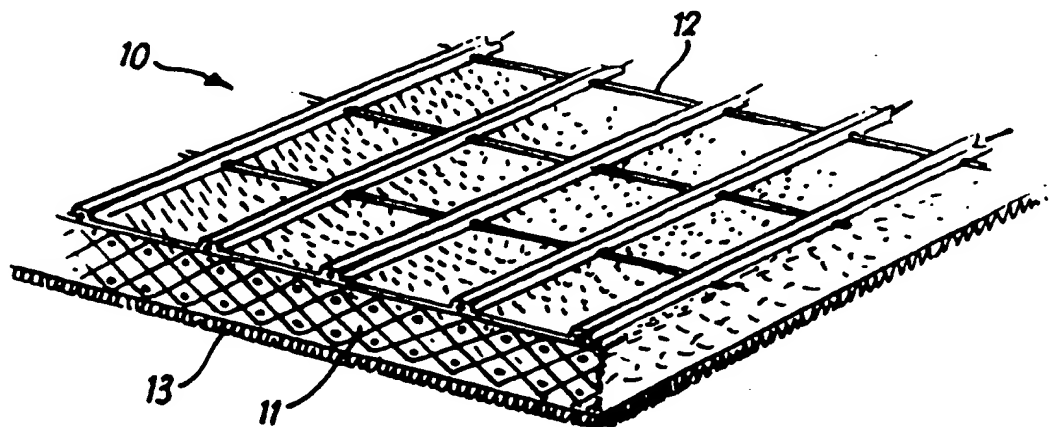
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(54) Title: PAPERMAKERS IMPRESSION FABRIC



## (57) Abstract

A papermakers impression fabric (10) comprises a nonwoven layer (12) in combination with a support fabric (11). The nonwoven layer (12) is located at the pulp or paper supporting surface of the fabric. The nonwoven layer comprises polymer lands (15) which act to emboss the surface of the sheet of pulp or web of paper located thereon.

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### **PAPERMAKERS IMPRESSION FABRIC**

The present invention relates to a papermakers impression fabric which is preferably, but not exclusively, for use in the press section of a pulp dryer machine or paper machine.

Press fabrics are used during the manufacture of pulp or paper to carry the formed soft and moist pulp sheet or paper web through presses as water is progressively squeezed out of the sheet or web.

Conventionally, press fabrics for paper comprise one or more woven or nonwoven basecloths and one or more layers of staple fibres, typically consisting of polyamide, secured to the base cloths, by needling. These conventional press felts are engineered such that they do not mark the paper web which is supported on the felt.

However, sometimes it is preferable to use an impression fabric, i.e. a press fabric with an embossing surface for providing a system of channels in the surface of the pulp sheet or paper web. This is desirable in that a pulp sheet having a series of channels therein, and therefore a greater surface area, can be dried more efficiently by the hot air flow which is directed at the sheet in the drying section of the pulp dryer machine. Thus, where a planar pulp sheet surface is not required, the pulp sheets entering the drying section from the press section ideally have a profiled or embossed surface so as to improve the drying efficiency in the pulp drying section, particularly when a Flakt (trade mark) pulp dryer is used. In fact the rate of drying is essentially directly proportional to the surface area of the pulp. Thus the surface of the pulp felt is ideally non-planar so as to provide an embossed surface on the pulp sheet. The high surface area of the embossed pulp sheet is important in that jets of hot air are used to dry the sheet as opposed to a conventional paper machine dryer section where heated

smooth cylinders are used to dry the paper web.

The embossing surface is desirable for providing a similar channel system impression in a paper web in that an aesthetically pleasing pattern is obtained in the final paper product.

In either case this is in stark contrast to conventional press felts for papermaking which must not impart any mark onto the paper web. A typical example of a papermakers impression fabric is found in US 5,225,269 in which the embossing effect is provided by coarse machine direction yarns on the pulp-contacting surface of a woven fabric.

By far the most common cause of failure of press fabrics of this type is due to compaction of the coarse embossing yarns which are reduced from having a spherical profile in cross-section to a much flatter profile.

There are also technical difficulties in weaving structures of the type described in US 5,225,269. For example, the use of such coarse yarns results in slower production speeds. This is because the use of increased weight yarns allows only a little length of a yarn to be taken up by the shuttle pirn. Therefore the pirn has to be replaced more often than for a similar fabric which does not use these coarse woven yarns.

The present invention has been made from a consideration of these problems and seeks to provide a fabric which resists compaction and retains its original surface configuration to a much greater extent, over a long period of time, compared with prior art impression fabrics and therefore provides for easy release of the pulp sheet or paper web therefrom.

According to the present invention there is provided a papermakers impression

fabric, said impression fabric having a pulp or paper support surface and a non-support surface, the impression fabric comprising a nonwoven layer in combination with a support fabric, and wherein the nonwoven layer is located at the pulp or paper supporting surface of the fabric, the nonwoven layer comprising polymer lands which, when in use, act to emboss the surface of the sheet of pulp or web of paper located thereon.

The press fabric in accordance with the present invention exhibits superior resilience and thus greater resistance to compaction than known prior art designs due to the inherent resilience of the polymeric layer. The lands of the nonwoven layer ideally comprise elastomeric material for increased resilience. A thermoplastic material is further preferred for these lands. Suitable examples of the matrix material for the lands includes any of the following either alone or in combination:- polyurethane such as thermoplastic polyurethane, silicone, polyester, polyamide or thermoplastic elastomer

The structures of the invention are quicker and less complicated to make than similar prior art designs. Since the embossing pattern does not depend on a woven structure the impression fabrics according to the present invention show improved reproducibility. Furthermore, an easily defined surface structure is achieved so that the pulp-contacting surface area of the felt is optimised for maximum drying efficiency.

The support fabric may comprise a woven fabric and/or at least one nonwoven structure such as a membrane, possibly made in accordance with the method described in GB 2202873 or needlefelt. As the press fabric is used with a demand on stability it is essential that the fabric has sufficient strength in the intended running direction or machine direction thereof. This may be achieved by providing yarns in at least some of

the lands of the nonwoven structure, such as the nonwoven membrane, the yarns extending in a direction substantially equivalent to the intended machine direction of the fabric. These yarns are at least partially encapsulated in the machine direction lands.

In a first preferred embodiment of the invention the nonwoven layer supporting the pulp sheet or paper web comprises a nonwoven membrane, preferably in the form of a mesh, comprising machine direction and cross-machine direction polymer lands. At least one in two of these machine direction lands contain a yarn in order to provide a dimensionally stable structure. These yarns are preferably multifilament yarns owing to their compressibility. Alternatively a monofilament, twisted or cabled yarn may be used. The distance between the midpoints of the machine direction lands is ideally in the range of 1.5 mm to 5.0 mm. The machine direction lands may be any shape when viewed in cross-section, such as square, rectangular, triangular, round, semi-circular or oval. However, the preferred profiles of at least some of the machine direction lands is as shown in fig.3 attached hereto owing to the greater contact area with the pulp or paper and increased resistance to compaction. The top of the triangular profile may be missing so as to provide a truncated triangular shape. A groove may be provided in the top of the truncated triangular structure.

The cross-machine direction lands preferably lie below the upper surface plane of the machine direction lands, for example, at 85% thickness of the machine direction lands, and should be of the same height to avoid the formation of cells which would create a pattern of low density and high density pulp or paper fibre regions. However, the use of the raised cross-machine direction lands (i.e. at 100%) thickness should not be discounted since they might reduce the pressure footprint and therefore improve the

resistance of the felt to compaction. One or more layers of staple fibre comprising different types of polyamide are preferably provided on the pulp or paper side of the fabric or support.

The membrane geometry may be altered so that every one machine direction land contains a yarn, but these yarns are ideally separated by a greater distance of say 3.0 mm to 4.0 mm. At least some of the cross-machine direction lands may contain a yarn. The cross-machine direction lands may run perpendicular to the machine direction lands or may be set at another angle up to 45°.

In a second preferred embodiment of the invention the nonwoven layer supporting the pulp sheet or paper web comprises a fibrous nonwoven batt containing polymer lands extending generally in the machine direction of the fabric. At least one in two of these lands contain a yarn in order to provide a dimensionally stable structure. These yarns are preferably multifilament yarns owing to their compressibility. Alternatively a monofilament, twisted or cabled yarn may be used. The distance between the midpoints of the machine direction lands is ideally in the range of 1.5 mm to 5.0 mm. The machine direction lands may be any shape when viewed in cross-section, such as square, rectangular, triangular, round, semi-circular or oval. This layer is preferably formed from a strip of fibrous batt material consisting of e.g. polyamide a continuous, at least partially encapsulated yarn which have been wound around a fabric support structure in a helical fashion.

The support fabric is ideally secured to the nonwoven layer, for example, by bonding with adhesive or by needling.

Staple fibres may be secured to one or both sides of the press fabric so as to hold water which is expelled from the pulp sheet or paper web when travelling through

the press nip of the machine. However, it is important that the nonwoven layer is able to provide an embossed surface on the pulp sheet or paper web. Therefore the embossing surface of the press fabric should not be masked by an excessive amount of staple fibre and much less staple fibre is present at the embossing pulp or paper contacting surface of the press fabric than conventional press fabrics or indeed none at all may be provided. However, the remote side of the fabric ideally comprises a sufficient amount of staple fibre to store water expelled from the pulp sheet or paper web to prevent rewetting. A sufficient amount of this fibre is also present to protect the machine side of the fabric from wear.

The fabrics of the present invention are easily jointed so as to provide a seamed belt. When using a seamed impression fabric a seamable (preferably woven) basecloth is used. The endless nonwoven membrane is then placed over the base and batt fibre is subsequently needled into the fabric, with the membrane/batt fibre assembly being cut over the seam region so as to provide a superior joint. Alternatively strips of batt fibre and a reinforcing land (i.e. an at least partially encapsulated and/or impregnated yarn) are bonded to the base in a helical fashion and then the polymer land/batt fibre assembly is cut over the seam region.

The coarse embossing yarns of prior art structures have to be spliced and often need to be secured in place with adhesive to stop them separating from the body of the fabric. Furthermore the channel formed in the splice region is less pronounced in the fabrics made using the nonwoven layers of the invention. This is because the nonwoven layer is stiffer and more dimensionally stable than a springy coarse multifilament. Thus the pulp sheets or paper webs made on the fabric of the invention are less prone to breakage.



The fabric of the present invention has particular application in the press section of a pulp dryer machine. The fabric of the invention may be used to imprint a desired embossing pattern on a tissue web. The fabric of the invention may also be used as a papermakers fabric to give a desired embossing pattern in a paper web on a Yankee (MG) cylinder. For a so-called MG impression fabric a higher temperature-resistant nonwoven layer polymer land material is needed, preferably polyester (e.g. Hytrel) or polyamide.

In order that the present invention may be more readily understood a specific embodiment of the invention will now be described by way of example only with reference to the accompany drawings in which:-

Fig. 1 is a perspective view of one fabric in accordance with the present invention;

Fig. 2 is a cross-section through the cross-machine direction of the fabric of fig 1, and

Fig. 3 shows alternative designs for the machine direction lands of the nonwoven material of the fabric of figs. 1 and 2.

Referring to figs. 1 and 2 a papermakers impression fabric 10 for use as a fabric in the press section of a pulp dryer machine comprises a two-layer woven base fabric 11, which is secured to a nonwoven 12 mesh membrane by needling. The nonwoven membrane 12 is preferably made in accordance with the method disclosed in GB 2202873 in which the cross-machine direction and machine direction lands are fused together. The edges of the membrane may be joined in accordance with the method described in GB 2254287. A batt 13 of staple fibres is secured to the base of the fabric by needling. In use this base of the fabric 10 is located to the side of the fabric that is

remote from the pulp sheet or paper web which is supported on the fabric.

In use the pulp sheet or paper web is supported by the nonwoven membrane

11. In the nonwoven membrane 12 the cross-machine direction lands 14 lie below the surface plane of the machine direction lands 15; for example at 85% of the thickness of the machine direction lands. The cross-machine direction lands 14 are all set at a uniform height. Yarns 16 are provided in the machine direction lands 15 so as to provide additional strength in the machine direction.

The machine direction lands may be square in cross-section. However, they are preferably in the form of a truncated triangle in cross-section as shown in fig.3a, a triangle as shown in fig.3b or a truncated triangle having a longitudinally extending groove therein as shown in fig.3c.

The nonwoven membrane acts to emboss a mesh pattern in the pulp sheet or paper web supported thereon. This mesh channel pattern acts to optimise drying of the pulp sheet in the drying section of a pulp dryer machine, or to provide an aesthetically pleasing embossed pattern in a finished paper product.

It is understood that the above described embodiment is by way of illustration only. Many modifications and variations are possible.

CLAIMS

1. A papermakers impression fabric, said impression fabric having a pulp or paper support surface and a non-support surface, the impression fabric comprising a nonwoven layer in combination with a support fabric, and wherein the nonwoven layer is located at the pulp or paper supporting surface of the fabric, the nonwoven layer comprising polymer lands which, when in use, act to emboss the surface of the sheet of pulp or web of paper located thereon.
2. A papermakers impression fabric as claimed in claim 1, wherein the said polymer lands of the nonwoven layer comprise elastomeric material.
3. A papermakers impression fabric as claimed in claim 1 or claim 2, wherein the said polymer lands of the nonwoven layer comprise thermoplastic material.
4. A papermakers impression fabric as claimed in any preceding claim, wherein the said polymer lands of the nonwoven layer comprise any of the following either alone or in combination:- polyurethane, silicone, polyester or polyamide.
5. A papermakers impression fabric as claimed in any preceding claim, wherein yarns are provided in at least some of the lands of the nonwoven layer.
6. A papermakers impression fabric as claimed in any preceding claim, wherein the support fabric comprises a woven fabric.
7. A papermakers impression fabric as claimed in any preceding claim, wherein the support fabric comprises a nonwoven fabric.
8. A papermakers impression fabric as claimed in claim 7, wherein the support fabric comprises a membrane comprising a plurality of lands.
9. A papermakers impression fabric as claimed in claim 8, wherein yarns are provided in at least some of the lands of the support fabric.

10. A papermakers impression fabric as claimed in any preceding claim, wherein the profile of at least some of the lands of the nonwoven layer, when viewed in end elevation, is triangular or is a truncated triangular shape optionally with a groove in the truncated area thereof.

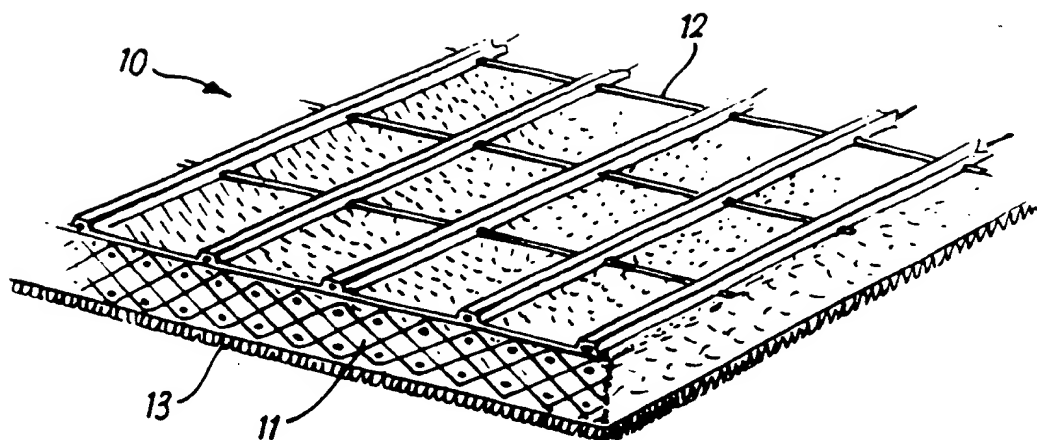
11. A papermakers impression fabric as claimed in any preceding claim, wherein the lands of the nonwoven layer that extend in the intended cross machine direction of the fabric lie below the upper surface plane of the lands of the nonwoven layer that extend in the intended machine direction fabric.

12. A papermakers impression fabric as claimed in any preceding claim, wherein the nonwoven layer comprises a fibrous nonwoven batt containing polymer lands extending generally in the intended machine direction of the fabric.

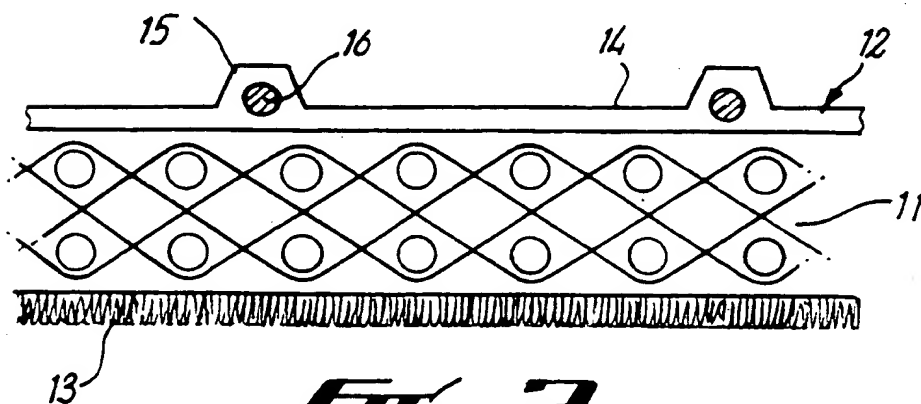
13. A papermakers impression fabric as claimed in any preceding claim, wherein the distance between the midpoints of adjacent lands in the nonwoven layer is in the range from 1.5 mm to 5.0 mm.

14. A papermakers impression fabric as claimed in any preceding claim, wherein the support fabric is secured to the nonwoven layer by bonding, with adhesive or by needling

15. A papermakers impression fabric as claimed in any preceding claim, wherein stable fibres are secured to one or both of the top and base of the impression fabric.



**FIG. 1**



**FIG. 2**

**FIG. 3a**



**FIG. 3b**



**FIG. 3c**



# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 97/02702

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 D21F7/08

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 D21F D04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	GB 2 254 288 A (SCAPA GROUP PLC) 7 October 1992 see page 6 ---	1
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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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